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Astyanax tumbayaensis, a new species from northwestern Argentina highlands (Characiformes: Characidae) with a key to the Argentinean species of the genus and comments on their distribution

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***Astyanax tumbayaensis*, a new species from northwestern Argentina highlands (Characiformes: Characidae) with a key to the Argentinean species of the genus and comments on their distribution.** - A new species of the characid genus *Astyanax* is described from a man-made small channel connected with the Río Grande basin, in Jujuy Province, northwestern Argentina. This species can be distinguished from its congeners by the following combination of characters: body relatively high (39.2-45.3% SL); head short and heavy (24.0-26.7% SL); snout very short (16.1-20.8% HL); eye small (28.9-35.0% HL); interorbital very wide (38.8-44.1% HL); mouth sub-superior; maxilla short with 1-2 teeth; iii-v, 19-22 anal fin rays; 33-36 perforated scales on the lateral line, and a distinctive color pattern, consisting in a reticulated body, with dorsal, pelvic, anal, and caudal fins with dark margins. A very narrow lateral dark stripe ending in a caudal spot, and one large vertically elongated humeral spot. In addition the males of *Astyanax tumbayaensis* have bony hooks in the dorsal, pelvic, anal and caudal fins. A key for Argentinean species of *Astyanax* is provided. The primary traits of the distribution of species in the country are discussed, with reference to the main basins and some zoogeographically important localities.

Keywords: Ostariophysi - biodiversity - *Astyanax* - taxonomy - new species - distribution - northern Argentina.

INTRODUCTION

In northwestern Argentina marked differences in climate, altitude and vegetation, with a considerable diversity of aquatic habitats, occur within short distances (Ringuelet, 1975; Menni, 2004). This area is considered a part of the Paranensean Region (Arratia *et al.*, 1983), but the composition of its fish fauna is neither identical

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to that of the Pampasic region nor to that of the Río Paraná. Some species that had been considered identical to those of northeastern Argentina have been shown to be different, for example *Bryconamericus thomasi* Fowler, believed to be a synonym of *B. iheringi* (Boulenger), but revalidated by Miquelarena & Aquino (1995).

The new species, described here, belongs to the diverse genus *Astyanax*, occurring in a high altitude area along the Humahuaca Quebrada (a valley), which is almost desertic in its upper portion, but receives abundant summer rains from 1000 to 1400 m a.s.l. The Río Grande, which flows through Jujuy province in Argentina, is the largest natural environment close to the Tumbaya channel, has an impoverished Paranensean fauna, including *Trichomycterus boylei* Nichols and *T. roigi* Arratia & Menu-Marque in its northern section, and *T. alterus* Marini, Nichols & Lamonte, *Corydoras micracanthus* Regan, *Astyanax eigenmanniorum* (Cope), *A. fasciatus* (Cuvier), *Moenkhausia intermedia* Eigenmann, and *Psellogrammus kennedyi* (Eigenmann) below 2100 m a.s.l. (Arratia *et al.*, 1983).

The purpose of this paper is to describe a new species of the genus *Astyanax* Baird & Girard, 1854 from a man-made channel connected with the Río Grande basin in Jujuy province, Argentina. As several new species of the genus have been described recently from Argentina, we provide a key for all the species of the genus reported for the country, as well as a synopsis of their distribution.

MATERIAL AND METHODS

Measurements to the nearest 0.01 mm were taken using a Digimess digital caliper following Fink & Weitzman (1974). Counts were made with a WILD M8 stereomicroscope. Osteological observations were made on three specimens cleared and stained (c&s) for bone and cartilage following Taylor & Van Dyke (1985). All measurements are expressed as percentage of standard length (SL), except for head measurements, which are recorded as percentage of head length (HL). In all counts, frequencies are given in parentheses and the holotype is indicated by an asterisk. Material is deposited at the Instituto de Limnología de La Plata "Dr. Raúl A. Ringuelet" (ILPLA), Museo de La Plata (MLP), Argentina and Muséum d'histoire naturelle Genève, Switzerland (MHNG).

For the construction of the key, we took into account easily-observed features, avoiding those that represent small differences within a continuous range. In a few cases, we used anatomical features, but these are clearly identifiable. The key is strictly dichotomic, but within dilemmas that end in a single species, we included, within parenthesis, some particular traits that might be useful to confirm the identification. Several species were available for direct examination, but in some cases we relied upon published accounts. We did not consider the sub specific level.

Comparative material

Astyanax asuncionensis Géry, 1972: ILPLA 382, 2 ex., 44.4-64.8 mm SL, Urugua-í stream, Iguazú Department, Misiones Province, Argentina, coll.: C. R. Guillén, Apr. 1977.

Astyanax cordovae (Günther, 1880): ILPLA 44, 2 ex., 84.5-119.3 mm SL, Primero River, Córdoba province, Argentina, coll.: H. Haro, Sep. 1988.

Astyanax eigenmanniorum: (Cope, 1894) ILPLA 705, 5 ex., 53.8-77.1 mm SL, Laguna Chascomús (35°36' S-58°02' W), Buenos Aires Province, Argentina, coll.: C. Togo and H. López, May. 1979; ILPLA 716, 4 ex., 51.9-82.9 mm SL, Laguna Chascomús (35°36' S-58°02' W), Buenos Aires Province, Argentina, coll.: O. Padin and J. Iwaszkiw, Apr. 1984.

Astyanax cf. *fasciatus*: ILPLA 569, 6 ex., 70.7-80.6 mm SL, Brazo Chico stream, Entre Rios Province, Argentina, coll.: N. Landoni, Jan. 1985; ILPLA 596, 6 ex., 54.2-63.5 mm SL, Laguna de Lobos (35°17' S-59°07' W), Buenos Aires Province, Argentina, coll.: A. Miquelarena *et al.*, Jun. 1986.

Astyanax ita Almirón, Azpelicueta & Casciotta, 2002: MLP 9599, holotype ♂, 64.0 mm SL, Tateto Creek (25°47'12.8" S-53°56'12.9" W), Iguazú River basin, Misiones Province, Argentina, coll.: A. Almirón *et al.*, Feb. 2002.

Astyanax lineatus (Perugia, 1891): ILPLA 1487, 2 ex., 32.9-36.5 mm SL, Metán River (tributary of Juramento River), on Route 46, road between Punta del Agua and La Costosa, Salta, Argentina, coll.: A. Miquelarena *et al.*, March, 1987; ILPLA 1515, 10 ex., 50.0-74.5 mm SL, an unnamed creek before Huaico Mora creek, on the road between Zapla and Jujuy City, Jujuy, Argentina, coll.: A. Miquelarena *et al.*, March, 1987.

Astyanax ojiara Azpelicueta & García, 2000: MLP 9470, holotype ♂, 50.0 mm SL, Benítez stream, headwaters of Yaboty River, Uruguay basin, Misiones Province, Argentina, coll.: O. García, May. 1983; MLP 9472, 6 paratypes, 50.2-67.5 mm SL, collected with the holotype.

Astyanax paris Azpelicueta, Almirón & Casciotta, 2002: MLP 9585, holotype, 75.6 mm SL, Fortaleza Creek (26°45' S-54°10' W), Uruguay River basin, Misiones Province, Argentina, coll.: J.Casciotta *et al.*, Apr. 2000.

Astyanax troya Azpelicueta, Casciotta & Almirón, 2002: ILPLA 1152, 12 ex., 60.7-86.3 mm SL, Cuña-Pirú creek (27°10' S-54°57' W), Cainguás Department, Misiones Province, Argentina, coll.: R. Filiberto & F. De Durana, Sep. 1997; ILPLA 1154, 3 ex., 52.4-67.0 mm SL, Cuña-Pirú creek (27°10' S-54°57' W), Cainguás Department, Misiones Province, Argentina, coll.: R. Filiberto & L. Protogino, Nov. 1999; ILPLA 1156, 14 ex., 32.6-85.3 mm SL, Cuña-Pirú creek (27°10' S-54°57' W), Cainguás Department, Misiones Province, Argentina, coll.: A. Miquelarena *et al.*, Sep. 2000.

Astyanax hermosus Miquelarena, Protogino & López: ILPLA 1690, 1 ex., 78.5 mm SL, San Francisco River, Río Primero basin, Valle Hermoso (31°07' S-64°29' W), Punilla Department, Córdoba Province, Argentina, coll.: O. de Ferreri, Jan. 1965; ILPLA 1691, 19 ex., 48.7-77.9 mm SL; ILPLA 1692, 6 ex. (c&s), 47.0-51.1 mm SL; MHNG 2647.68, 4 ex., from the same locality as first.

Ctenobrycon alleni (Eigenmann & Mc Atee, 1907): MLP 6774, 5 ex., 54-64 mm SL, Laguna Setubal, Santa Fé Province, Argentina, coll: M. Galván & E. Martín.

DESCRIPTION OF THE NEW SPECIES

Astyanax tumbayaensis sp. n. Fig. 1; Table 1

Holotype: ILPLA 1702, ♂, 68.8 mm SL; man-made channel near the road crossing the village of Tumbaya (23°51' S-65°28' W), Grande River basin, Jujuy Province, Argentina, coll. R. Menni & A. Miquelarena, April 1987.

FIG. 1
Astyanax tumbayaensis sp. n., ILPLA 1702, holotype ♂, 68.8 mm SL.

Paratypes: ILPLA 1513, 7 ♀ (1c&s), 41.0-65.4 mm SL; ILPLA 1703, 1 juvenile and 1 ♀ (c&s), 25.7-33.4 mm SL; MHNG 2652.90, 2 ex. ♀, 45.6-59.6 mm SL, collected with the holotype.

DIAGNOSIS

Astyanax tumbayaensis differs from other species of the genus by the following combination of characters: body relatively high and compressed (39.2-45.3% SL), head short and heavy (24.0-26.7% SL), small eye (28.9-35.0% HL); interorbital broad (38.8-44.1% HL), snout very short (16.1-20.8% HL), caudal peduncle high (13.6-15.0% SL); mouth sub-superior; maxilla short, in a near vertical position in relation to the horizontal body axis, with 1 or 2 teeth, with 1 to 4 cusps; anal-fin rays iii-v, 19-22; perforated scales on lateral line 33-36. A distinctive color pattern, with a reticulated aspect of the body produced by the homogenously distributed melanophores of the scales. One large vertically elongated humeral spot. A very narrow dark line on the sides ending in a caudal spot. Dorsal, pelvic, anal and caudal fins with dark margins when the fish is alive. Males of the new species are distinguished by the presence of bony hooks on all fins excepting pectorals.

DESCRIPTION

Body high, with maximum depth at anterior dorsal-fin origin. Head short and heavy. Mouth sub-superior. Snout short, smaller than eye diameter. Interorbital wide. Maxilla short, in a near vertical position with respect the horizontal body axis. Lower jaw somewhat included. Premaxillary teeth visible when mouth closed.

Dorsal profile of head with conspicuous concavity at supraoccipital level. Dorsal body profile slightly convex from this point to dorsal-fin origin. Ventral body profile slightly convex from tip of lower jaw to anal-fin origin, straight along anal-fin base. Region immediately over anal-fin base strongly compressed. Caudal peduncle deep.

TABLE 1. Morphometric data of *Astyanax tumbayaensis* sp. n. presented as percentages of standard length (SL) and head length (HL). SD, standard deviation; n, number of specimens.

Character	Holotype (♂)	Paratypes (♀)				
		Range		Mean	SD	n
Standard length	68.8	41.0	65.4	50.5		9
% SL						
Head length	24.8	24.0	26.7	25.3	0.9	9
Predorsal distance	50.5	49.7	54.9	51.3	1.7	9
Prepectoral distance	23.0	24.0	28.4	26.1	1.6	9
Prepelvic distance	48.1	46.4	50.5	48.0	1.2	9
Preanal distance	64.7	65.4	69.8	67.7	1.3	9
Body depth	41.2	39.2	45.3	42.4	1.8	9
Dorsal fin base	15.3	11.7	14.8	14.1	0.9	9
Anal fin base	27.0	25.9	28.6	27.3	0.9	9
Dorsal length	27.1	23.6	27.7	26.3	1.2	9
Pectoral length	25.1	21.4	23.8	22.4	0.7	9
Pelvic length	18.8	14.3	18.9	16.8	1.3	9
Pectoral – pelvic distance	23.5	22.8	26.4	24.5	1.0	9
Pelvic – anal distance	20.4	17.3	21.9	19.9	1.6	9
Caudal peduncle length	13.3	11.3	13.6	12.3	0.8	9
Caudal peduncle depth	14.5	13.6	15.0	14.4	0.5	9
% HL						
Snout	16.2	16.1	20.8	17.8	1.7	9
Orbital diameter	28.9	30.7	35.0	32.9	1.4	9
Interorbital width	40.8	38.8	44.1	41.6	1.7	9
Maxilla length	27.9	25.3	30.8	27.8	2.0	9

Fins generally short. Dorsal-fin origin about midpoint of body length. Pectoral-fin origin at level of posterior border of opercle. Pectoral-fin tip close or not to the pelvic-fin origin (see sexual dimorphism below). Pelvic-fin origin at level of greatest body depth, anterior to dorsal-fin origin. Pelvic fin not reaching anal-fin origin. Anal-fin origin posterior to level of last dorsal-fin ray. Bony hooks in dorsal, pelvic, anal and caudal fins in males.

Dorsal-fin rays ii, 9 (11*); ii, 10 (1). Length of first unbranched ray about 1/3 to one half the second, last unbranched ray and first three branched rays longest. Pectoral-fin rays i, 11, i (6); i, 12, i (4*). Pelvic-fin rays i, 6, i (12*). Anal-fin rays iii, 20 (1); iii, 21 (4); iii, 22 (2); iv, 19 (2*); iv, 20 (1); iv, 21 (1); v, 21 (1).

Caudal-fin principal rays i, 17, i. Dorsal procurrent rays 11, ventral procurrent rays 8-9.

Cycloid scales regularly distributed. Lateral line complete, perforated scales 33 (2), 34 (4*), 35 (2), or 36 (3). Predorsal scales 12 (8*). Rows of scales from dorsal-fin origin to lateral line 6 (2), 7 (6*), and from lateral line to anal-fin origin 5 (3*) or 6 (7). Single row of 5-11 scales at anal-fin base.

Ascending process of the premaxilla short and wide, lateral process very wide, approximately rectangular in lateral view, bearing two rows of teeth. Outer row with 4 massive teeth (Fig. 2a), second one slightly out of line, with 3-5 cusps, typically

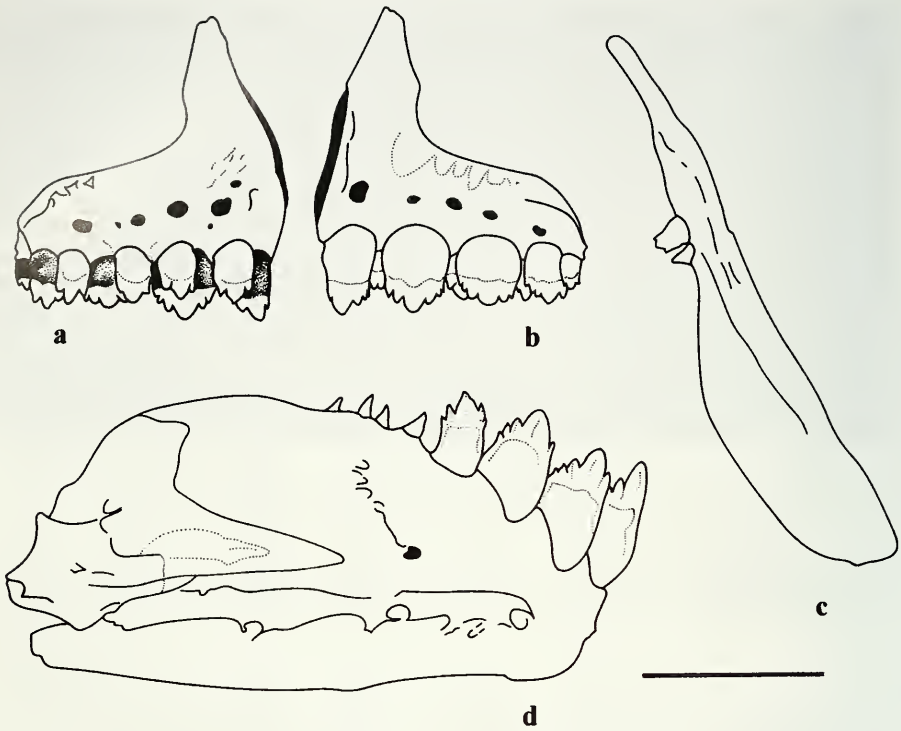

FIG. 2

Astyanax tumbayaensis sp. n., ILPLA 1513, paratype ♀, 45.6 mm SL. Right upper jaw: a. Premaxilla, external view; b. Premaxilla, internal view; c. Maxilla, external view; d. Right lower jaw, external view. Scale bar: 1 mm.

tricuspid; inner row with 5 teeth (Fig. 2b), symphysial tooth, narrowest and highest, with 4-5 cusps, followed by three very broad teeth with 5 to 7 cusps, typically with 6 cusps. These teeth decrease gradually in size from the symphysis. A fifth tooth, much smaller, usually tricuspid, placed internally to the fourth tooth, gives the series an irregular aspect. Maxilla with 1 or 2 teeth (Fig. 2c), with 1 to 4 cusps. Dentary short (Fig. 2d), with a series of 4 or 5 (usually 4) teeth, with 4 to 6 cusps, followed by a series of 2-4 smaller, monocuspid teeth.

Vertebrae 33-34. Supraneurals 5-6. Gill rakers 19-20, long and slender (6-7 on epibranchial, 1 on cartilage, 10 on ceratobranchial, and 2 on hypobranchial).Third infraorbital rather wide, covering all cheek excepting the antero-ventral portion.

COLOR IN ALCOHOL

Background clear brown, dorsal region of the body and head darker. Humeral spot vertically elongated, well developed. A second faint humeral spot about three scales behind the first. A thin line originating behind the second humeral spot and

FIG. 3
Man made channel in Tumbaya, Jujuy, Argentina, type locality of *Astyanax tumbayaensis* sp. n.

following to the caudal-fin base, finishing as an oval caudal spot that continues over the median caudal rays. Peritoneal region dark. All scales finely dotted in black, giving a reticulate aspect to the body. Third infraorbital, opercle, premaxilla, maxilla and dentary with densely concentrated dark chromatophores. Dark margins of the dorsal, pelvic, anal and caudal fins, very evident when fish is alive, fade quickly in preserved material. Distal third of the dorsal fin black. Pectoral-fin transparent.

SEXUAL DIMORPHISM

Bony hooks were observed on the dorsal, pelvic, anal and caudal fins of the holotype, a male. The hooks are blunt and small, there being one hook for each ray segment. The hooks on the pelvic fin are more numerous and somewhat more developed. The caudal fin bears only a few bony hooks on the principal rays.

The fins are generally more rounded in the male than in females. In the male the pectoral fin barely reaches the level of the pelvic-fin origin, and the latter does not reach the anal fin level by two scales. In the females the pectoral fin does not reach the pelvic-fin origin, whereas the latter does not reach the anal fin. The last unbranched ray and the first 5-6 branched rays of the anal fin are long giving the fin a lobed appearance.

ETYMOLOGY

The specific epithet refers to the name of the type locality.

Distribution and Habitat

Astyanax tumbayaensis is only known from the type locality, a channel pouring into Río Grande, in the Quebrada de Humahuaca, Jujuy Province, Argentina.

Astyanax tumbayaensis lives in a small man made, 17-20 cm deep, irrigation channel, beside the road that crosses the small village of Tumbaya (23°51' S-65°28' W, 2094 m a.s.l.) in northwestern Argentina (Fig. 3). The channel has a muddy bottom, with abundant organic deposits that are nearly totally covered by algae, with a few floating plants. Banks vegetated with grass and other plants. The environmental variables recorded in the same place some years after the original collection (19/10/98) indicate pH 8.1, water temperature 18.5°C (advanced spring) and low conductivity.

KEY TO THE ARGENTINEAN SPECIES OF *ASTYANAX*

A. gymnogenys Eigenmann, nominally reported by Pozzi (1945) from the Río Iguazú was also included in the key, considering that the locality is very close to the known geographical range of the species. Conversely, Buckup in Lima *et al.* (2003) reported *A. jacuhiensis* (Cope) from Argentina, but we were not able to trace the record for this country. Besides, it appears problematic to distinguish this species from *A. abramis* (Jenyns) and *A. asuncionensis* without some revisionary work. A similar situation is that of *A. orbignyanus* Cuvier & Valenciennes, which Eigenmann (1917) considered, at least in part, a synonym of *A. abramis*.

Géry (1978) reported nominally a subspecies of *A. taeniatus* (Jenyns) (a species with its type locality at Rio de Janeiro, Brazil) from southern Buenos Aires province, but the species has not been reported again from Argentina. The subspecies *A. scabripinnis paranae* was reported from Argentina by Fernández Santos (from El Palmar), by Miquelarena *et al.* (1997) (from Misiones) and by López *et al.* (2003). Buckup in Lima *et al.* (2003) considered this taxon as a species, but Garutti & Britski (2000) suggested that the populations attributed to it could consist in a complex of species. The present key is valid for *A. scabripinnis* in the sense of Bertaco and Malabarba (2001).

Several species formerly placed in *Astyanax*, including *A. erythropterus, A. alleni*, *A. pellegrini* and *A. correntinus*, are presently placed within the genus *Ctenobrycon,* as mentioned by Géry (1977). We were able to confirm this in the case of Argentine material referred to *Ctenobrycon alleni*, and therefore we did not include the latter species in the key.

Many of the species considered show a secondary sexual character, the presence of bony hooks in all or some of the fins of males. This trait appears usually in the anal and pelvic fins (*A. asuncionensis*, *A. cordovae*, *A. eigenmanniorum*, *A.* cf. *fasciatus*, *A. ita*, *A. latens* Mirande, Aguilera & Azpelicueta, *A. lineatus*, *A. saguazu* Casciotta, Almirón & Azpelicueta, *A. scabripinnis*, *A. tupi* Azpelicueta, Mirande, Almirón & Casciotta). *A. ojiara, A. pynandi* Casciotta, Almirón, Bechara, Roux & Ruiz Diaz, 2003, *A. troya,* and *Astyanax hermosus,* have hooks in all fins. *A. leonidas* Azpelicueta, Casciotta & Almirón only lacks hooks in the dorsal fin and *A. tumbayaensis* only lacks hooks in the pectoral fin. *A. paris* apparently has no hooks. When hooks occur in fins other than the pelvic or anal, they are fewer and less conspicuous. These particularities may be useful to confirm an identification if males are part of the sample.

1 A well-defined horizontal humeral spot, rounded or oval 2
- Humeral spot vertically elongated 4
2 22 to 26 total anal fin rays, a single maxillary tooth, humeral spot horizontal and/or rounded with chromatophores forming a vertical band ventral to the spot . . . . . *A. troya*
- 27 or more total anal fin rays, without maxillary teeth 3
3 38 to 49 scales in the lateral line, humeral spot with a dark stripe extended upward and forward . . . . . *A. abramis*
- 33 to 40 scales in the lateral line, humeral spot without the abovementioned traits . . . . . *A. asuncionensis*
4 Vertical humeral spot surrounded by a clear area (*Anal rays 24-31, scales in the lateral line 34-37*) . . . . . *A. pynandi*
- Vertical humeral spot without a clear area around 5
5 Y-shaped humeral spot (*mouth directed upward, anal rays 21 to 26, scales in the lateral line 35-38*) . . . . . *Astyanax hermosus*
- Differently shaped humeral spot 6
6 43-45 scales in the lateral line, without maxillary teeth . . . . . *A. cordovae*
- Less than 43 scales in the lateral line, with 1 or more maxillary teeth. 7
7 Without caudal spot (*40-41 scales in the lateral line, 1 maxillary tooth)* . . . . . *A. gymnogenys*
- With caudal spot 8
8 Dark stripes between the scale rows on the sides, forming a well-defined longitudinal striated pattern . . . . . *A. lineatus*
- Without such a pattern 9
9 Interorbital width 36.5 to 44.1% of head length 10
- Interorbital width 26.9 to 35.6% of head length 12
10 Mouth directed upward; deeper body, 39.2-45.3% SL . . . . . *A. tumbayaensis*
- Mouth terminal and lower body 11
11 Eye relatively larger, more than 32% in head length, body depth 35.5-39.58 % SL. . . . . *A. eigenmanniorum*
- Eye relatively smaller, 29.7% in head length, body depth 33.3-34.4% SL . . . . . *A. scabripinnis*
12 Three lateral spots: a supraopercular spot followed by 2 humeral spots (*28 a 33 anal rays, with 2 or 3 maxillary teeth*). . . . . *A. tupi*
- Less than 3 lateral spots. 13
13 Lateral stripe inconspicuous, color in life uniformly silvery (*28-34 anal rays, 1 to 4 maxillary teeth)* . . . . . *A. latens*
- Lateral stripe conspicuous, other coloration pattern 14
14 More than one maxillary tooth 15
- One maxillary tooth 16
15 Total anal rays 31 to 35 . . . . . *A. saguazu*
- Total anal rays 24 to 27. . . . . *A. paris*
16 Maxillary tooth with less than 7 cusps 17
- Maxillary tooth with 7 cusps 18
17 29 to 32 or more total anal rays, 38 to 41 scales in the lateral line . *A. fasciatus*

- 20 a 25 total anal rays, 35 to 37 scales in the lateral line ..... *A. leonidas*
18 Eye relatively smaller, 29.1 to 37.2% in head length ..... *A. ojiara*
- Eye relatively larger, 38.6 to 43% in head length ..... *A. ita*

DISCUSSION

The genus *Astyanax* comprises about 90 species occurring from southern United States of America (Eigenmann, 1921) to the lower Río Colorado in southern Buenos Aires Province (Almirón *et al.*, 1997). It is probable that this genus, like other genera included within the Characidae (e.g. *Hyphessobrycon, Moenkhausia, Bryconamericus, Hemigrammus*), may not be monophyletic (Weitzman & Malabarba, 1998; Lima *et al.*, 2003).

Eighteen species of the genus have been reported from Argentina (López *et al.*, 2003). *Astyanax tumbayaensis* belongs to a group of species with a low number of branched anal rays (*A. ojiara* 20-23, *A. leonidas* 17-21, *A. troya* 18-21, *Astyanax hermosus* 17-22, *A. pynandi* 21-26, *A. paris* 20-22, *A. ita* 20-24, *A. eigenmanniorum* 18-22). *Astyanax tumbayaensis* also shares with the first five species, the presence of bony hooks in all or nearly all fins of males.

Besides its color pattern, *A. tumbayaensis* differs from the mentioned species in the following characters:

From *A. ojiara* because of its shorter head (24.0-26.7 vs. 26.5-29.7% SL), shorter snout (16.1-20.8 vs. 24.5-30.9% HL), wider interorbital (38.8-44.1 vs. 31.0-35.6% HL), and larger number of teeth in the maxilla (1-2 with 1-4 cusps vs. 1 hepta-cuspid). Moreover, males have hooks in the dorsal, pelvic, anal and caudal fins (vs. males with hooks in all fins).

From *A. leonidas* because of its shorter head (24.0-26.7 vs. 22.7-32.8% SL), higher body (39.2-45.3 vs. 30.2-35.3% SL), wider interorbital (38.8-44.1 vs. 26.9-30.4% HL), smaller eye (28.9-35.0 vs. 34.3-41.2% HL) and males with hooks in dorsal fin (vs. males without hooks in dorsal fin).

From *A. troya* because of the wider interorbital (38.8-44.1 vs. 27.6-33.4% HL), smaller eye (28.9-35.0 vs. 35.0-44.6% HL), larger number of maxillary teeth (1-2 vs. 1) and males with hooks in the dorsal, pelvic, anal and caudal fins (vs. males with hooks in all fins).

From *A. paris* because of its higher body (39.2-45.3 vs. 34.9-39.4% SL), wider interorbital (38.8-44.1 vs. 28.4-32.8% HL), smaller eye (28.9-35.0 vs. 33.1-40.6% HL), and lower number of maxillary teeth (1-2 vs. 3-4).

From *A. ita* because of its smaller eye (28.9-35.0 vs. 38.6-42.0% HL); wider interorbital (38.8-44.1 vs. 27.8-33.5% HL), and higher number of maxillary teeth (1-2 vs. 1).

From *A. eigenmanniorum* because of the mouth position (sub-superior vs. terminal), deepest body (39.2-45.3 vs. 35.5-39.6), lesser orbital diameter (28.9-35.0 vs. 37.4-41.4% HL), higher number of maxillary teeth (1-2 vs. 1), and males with hooks in the dorsal, pelvic, anal and caudal fins (vs. males with hooks in the pelvic and anal fin).

The new species differs from *A. pynandi* from the Iberá wetlands, in the smaller orbital diameter (28.9-35.0 vs. 36.7-43.5% HL), the number of maxillary teeth and

cusps (1-2 with 1-4 cusps vs. 1 with 5-7 cusps), and because of the presence in males of bony hooks in the dorsal, pelvic, anal and caudal fins (vs. males with hooks in all fins).

Within the group with low number of anal rays, *A. tumbayaensis* also differs from some species described from southern Brazil. Thus, in *A. brachypterygium* Bertaco & Malabarba, the number of branched anal rays is still lower than in *A. tumbayaensis* (15-17 vs. 19-22) and the interorbital is narrower (27.5-35.6 vs. 38.8-44.1% HL). Besides, body depth is lower (27.5-38.0 vs. 39.2-45.3% SL) and the snout longer (20.7-26.8 vs. 16.1-20.8).

The very low number of branched anal-fins rays (13-15) clearly separates *A. cremnobates* Bertaco & Malabarba from *A. tumbayaensis* which has a larger number of anal-fin rays (19-22). In addition, the interorbital width is larger in the latter species (38.8-44.1 vs. 25.1-33.6).

A. gymnogenys, with a similar, although somewhat lower, number of total anal rays (21-22 vs. 22-26), differs from *A. tumbayaensis* because it lacks a caudal spot and has a single maxillary tooth.

A. scabripinnis paranae, described from the Upper Paraná basin, also has a number of total anal rays close to *A. tumbayaensis* (17-23 vs. 22-26), and a body depth lower than in the latter (33.0 vs. 39.2-45.3% SL).

A. latens was recently described for the upper basin of the Bermejo River, in Salta. *Astyanax tumbayaensis* differs from this species by the wider interorbital (38.8-44.1 vs.27.5-32.2% HL), smaller eye (28.9-35.0 vs. 35.9-42.1% HL), lesser number of branched anal rays (19-22 vs. 24-29), and different color pattern.

Astyanax tumbayaensis also differs from *Astyanax hermosus*, described from the Primero River basin in central Argentina by Miquelarena *et al.* (2005), in body height (39.2-45.3 vs. 33.1-38.7% SL), lower number of lateral line scales (33-36 vs. 35-38), different morphology of teeth and jaw bones, color pattern and distribution of the hooks in the fins of males.

There was a recent burst of descriptions of new species of *Astyanax* (Almirón *et al.*, 2002, Azpelicueta *et al.* 2002a, 2002b, Azpelicueta & García, 2000, Casciotta *et al.*, 2003a, 2003b, Mirande *et al.,* 2004, Miquelarena *et al.*, 2005) from north-eastern Argentina, reminding of the statement that some habitats within the Paraná River basin have a high geographic complexity and should have high diversity (Margalef, 1977; Menni, 2004). In some cases it is still early to know if these species are really endemics of the area. For example, another characid, *Hyphessobrycon meridionalis* (Ringuelet *et al.,* 1978), originally described from temperate Argentina, were soon after found in coastal river basins of Rio Grande do Sul, Brazil. Up to now, *A. troya, A. pynandi, A. hermosus, A. cordovae, A. tumbayaensis, A. tupi, A. latens, A. saguazu, A. paris, A. leonidas, A. ojiara* and *A. ita* are Argentine endemics.

The new species here described from northwestern Argentina, is part of the Paranensean fauna, since Arratia *et al.* (1983) extended the Paranensean Dominion to the lower ranges of the Andes. That fauna include many characids, loricariids, and trichomycterids, some of them endemic, as well as *Astyanax tumbayaensis*.

All species of *Astyanax* in Argentina live within the Parano-platense and Alto Paraná provinces of the Paranensean Dominion (Ringuelet, 1975; Arratia *et al.*, 1983).

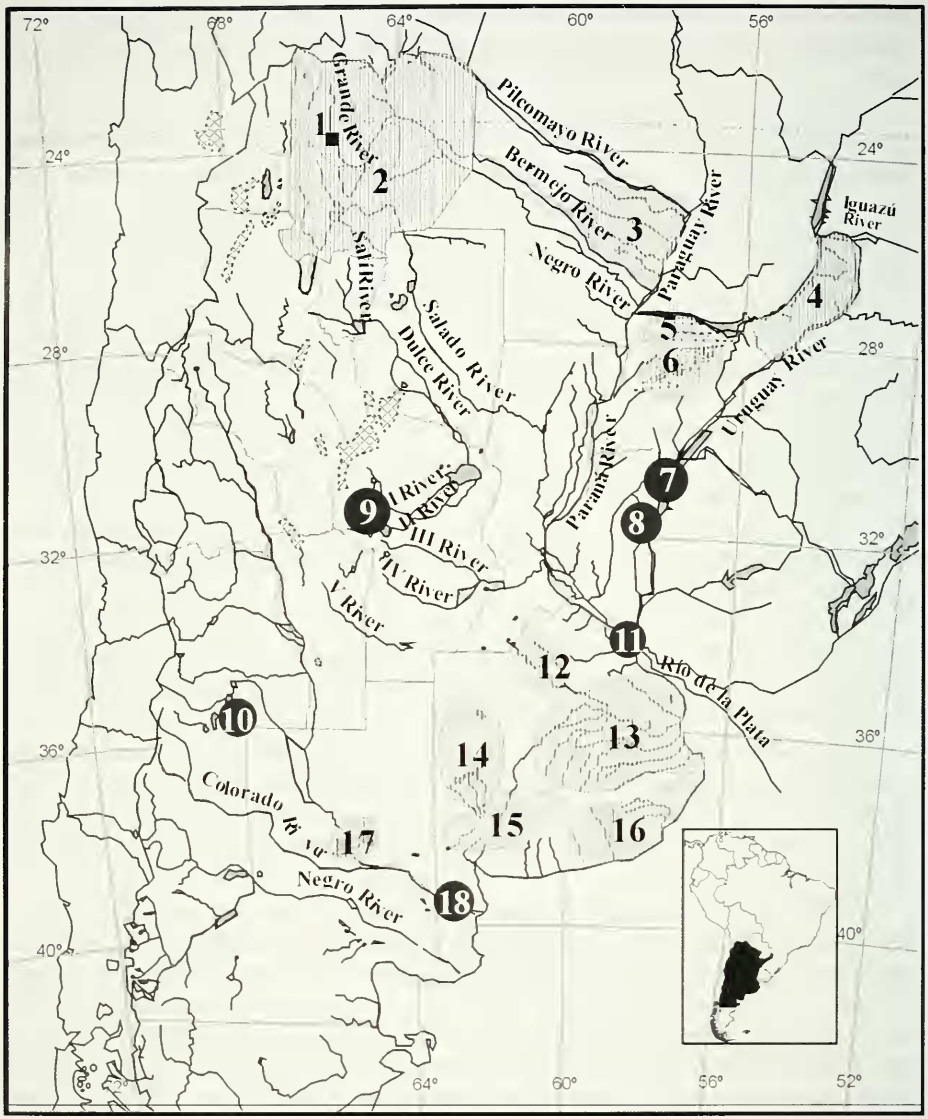

FIG. 4

Distribution of Argentinean species of *Astyanax*.1, type locality of *Astyanax tumbayaensis* sp. n; 2, Río Grande basin and other basins in the provinces of Salta and Jujuy; 3, flood plain of the Río Paraguay in Formosa Province; 4, Misiones Province; 5, Río Santa Lucía and swamps; 6, Iberá swamps system; 7, Salto Grande dam; 8, El Palmar National Park; 9, highland environments in Western Córdoba; 10, El Nihuil dam; 11, Río Paraná delta; 12, lenthic environments in northwestern Buenos Aires Province; 13, Chascomús Lake and other environments from the Río Salado basin; 14, lenitic environments in western Buenos Aires Province; 15, Sierra de la Ventana highlands; 16, small streams of the Atlantic drainage; 17, lenthic environments in La Pampa Province; 18, lower Río Colorado.

Their distribution show the general pattern displayed by most of the Paranensean fishes, in a fanlike form from the Paraguay and Paraná rivers to the eastern border of the Andes in the northwest and the Pampasic Highlands in central Argentina (Fig. 4). There are not references of the genus from the central western part of Argentina, in the provinces of Catamarca, La Rioja, San Juan and Mendoza (which are not part of the Paranensean Dominion), though in the latter *A. abramis* and *A.* cf. *fasciatus* were introduced in El Nihuil dam (Protogino, 1987). To the West, the distribution border at the level of central Argentina is about the 65°W with references of *A. eigenmanniorum* from localities in southwestern Córdoba province (Menni *et al.*, 1984; Miquelarena & Menni, 1992).

In spite of being very common in pampasean environments, no species of the genus occurs in the highlands of Sierra de la Ventana, which is one of the limits of the Paranensean fishes to the South. Instead, *A. eigenmanniorum* was reported from the Río Colorado (Almirón *et al.*, 1997), at the northern border of Patagonia, and it occurs in La Pampa province. At the South of the Buenos Aires province, which is about the southern border of the Pampas, *A. eigenmanniorum* is known from small streams of the Atlantic slope. It is very common in the "lagunas" (third order lakes) of the Pampas plain. Several species of *Astyanax* are frequent and often sympatric in these environments, though some of the reports should be revised. *A. eigenmanniorum,* and at least another species, colonized small man-made environments related with the Río de la Plata, where they differ in their reproductive periods (Menni & Almirón, 1994). In the Chascomús pond *A. eigenmanniorum* is in the seventh place in percentage of number of individuals (Alaimo & Freyre, 1969), and is the most abundant species at the middle levels in a high gradient stream in central Argentina (Videla & Bistoni, 1999). This species occurs in small rivers and creeks pouring in the Río de la Plata and in small creeks from the Río Uruguay basin at El Palmar National Park. *A. eigenmanniorum* has been reported also from the Primero, Segundo, Tercero, Cuarto and Quinto rivers in Córdoba province, the Salado and Dulce rivers in Santiago del Estero province and from many environments in the provinces of Salta and Jujuy.

Astyanax abramis is known from the pampas "lagunas", the Río de la Plata, the Río Paraná delta, the Paraná, Paraguay and Uruguay rivers, including the Salto Grande dam, from the flood plain of the Río Paraguay in Formosa, and from the Río Salí in Santiago del Estero province. It was introduced at El Nihuil dam.

Astyanax asuncionensis has been reported from the Pampas "lagunas", the Río de la Plata, the Río Paraná delta, the Primero and Segundo rivers in Córdoba province, and the Salado and Salí rivers in Santiago del Estero province. It is also known from many environments in the provinces of Salta and Jujuy in northwestern Argentina, from Río Negro environments in the Chacoan area, from the Paraná, Paraguay and Uruguay Rivers, the Salto Grande dam, from small ponds and swamps related with the Río Santa Lucía in northwestern Corrientes province, the Esteros del Iberá and from the flood plain of the Paraguay River in Formosa province.

Astyanax cordovae is endemic from the Primero and Segundo rivers in Córdoba province.

Astyanax ita and *A. gymnogenys* are known from the Río Iguazú. *Astyanax latens* is known from the Río Bermejo basin in Salta province. *Astyanax leonidas* and *A. troya* are known from small streams of Río Paraná basin.

Astyanax lineatus is known from many environments in the provinces of Salta and Jujuy, from the Paraná and Paraguay rivers, from small environments related with the middle Río Paraná, the Esteros del Iberá and the flood plain of the Río Paraguay in Formosa province.

Astyanax ojiara, A. paris and *A. saguazu* have been reported from small streams of the Río Uruguay basin. *Astyanax pynandi* is known from the Esteros del Iberá. *Astyanax scabripinnis* is known from the Río Paraná and its delta and from the Río Uruguay basin at El Palmar National Park. *A. tupi* is known from the Río Paraná basin in Misiones province.

Astyanax hermosus is known from the Río San Francisco basin in Córdoba province (Miquelarena *et al.*, 2005), and *A. tumbayaensis*, here described, is known from Jujuy province.

Though some references should be revised, *A. fasciatus* has been reported from the "lagunas" of the Pampa plain, the Río de la Plata and small man-made environments related with it, the Río Paraná delta, the Segundo and Cuarto rivers basins in Córdoba province, the Río Salado in Santiago del Estero province and the Río Salí basin in Tucumán province. Also from the Paraná, Paraguay and Uruguay rivers, small environments related with the middle Río Paraná, the Esteros del Iberá, and the flood plain of the Río Paraguay in Formosa province. It is also known from El Nihuil dam and juvenile stages were reported from the lake of the Salto Grande dam.

As expected from the genus distribution range, *Astyanax* species are rather eurytopic. Both *A. eigenmanniorum* and *A. asuncionensis* tolerate a conductivity range from very low values to about 3,000 μS cm^{-1}. Along a high-low tolerance axis based in tolerance to maximum and minimum values of fourteen physic-chemical traits of the water, studied in eighteen species of several groups, the two mentioned species plus *A.* cf. *fasciatus* are the top three more resistant. *A. asuncionensis* and *A.* cf. *fasciatus* tolerate 8 maximum and 5 minimum values of the considered variables, these being the same for the two species (Menni *et al.*, 1996). Species of *Astyanax* are not restricted to lenthic environments, though they prefer slow flowing waters and use littoral vegetation as refuge (Menni *et al.*, 1984).

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